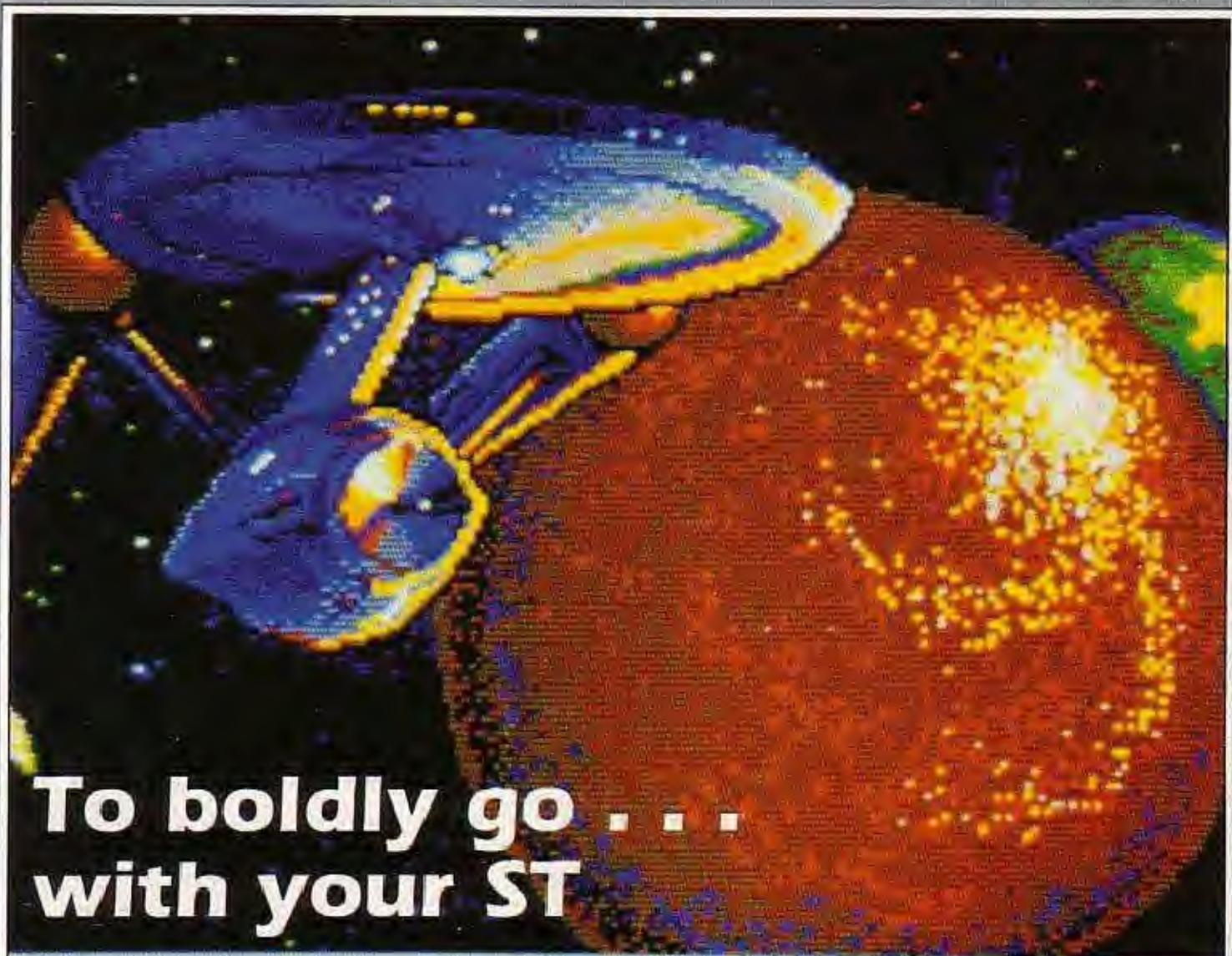


Vol. 1 No. 12

February 1987

Atari ST User



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- Three ST communications programs compared
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Atari launches Mega-ST flagships



NEW flagships of the Atari line, the Mega-ST workstations – just announced in Las Vegas – provide stunning power without the price in desktop publishing and professional applications. The new machines incorporate one, two or four megabytes of ram respectively, and come with integral 800k floppy disc drive, graphics blitter chip and detachable ergonomic keyboard.

Although they look completely different, all three micros are 100 per cent compatible with the existing Atari 520ST and 1040ST models.

Enhancements incorporated in the Mega-ST range include a battery-backed real time clock, internal mounting space for an additional circuit board, and full external routing of the 68000 bus. The architecture is left wide open for further enhancements which will include ram expansion capability up to 16Mb and networking.

Each Mega-ST is housed in a system unit 22 x 22 x 2 in containing the cpu, double-sided floppy disc drive and internal power supply. The normal complement of ST ports – DMA, RS-232 serial, parallel, disc, video, cartridge, Midi, mouse and joystick – plus an additional port for the keyboard, are included.

The unit is reinforced to support a monitor and can be stacked with other components, notably the enhanced 20mb hard disc drive.

The slimline Winchester drive, incorporating an extra port for daisy-chaining with other DMA-compatible peripherals like the new laser printer, was announced at the same time as the Mega-STs.

A sleek new chassis contains a redesigned ST motherboard. Standard equipment includes a battery-backed clock calendar which runs off alkaline penlight batteries.

Mega-ST architecture is wide open, permitting internal and external expansion with add-on circuit cards.

The new design provides full access to the 68000 bus and power supply, and fixtures have been provided for installing a circuit board inside the case.

Further expansion is possible by routeing the bus outside to an external card-cage.

The new keyboard can be lap-held, but has adjustable legs for desk use and can be adjusted to the user's preferred typing angle. Internally the keyboard has been enhanced with high quality key switches for improved tactile and auditory feedback, better feel and increased reliability.

The Mega-ST range, priced from \$1,000 up, was described at the launch by Atari Corp spokesman Neil Harris as "our flagships".

He added: "They are also proof that Atari has been listening to its users and taking their advice seriously".

The revolutionary Atari laser printer, shown in prototype at Las Vegas, matches or exceeds the

performance of other laser printer systems while costing only half as much at about \$1,500.

Coupled with the power of an ST the printer will form the output stage of a desktop publishing system costing less than \$3,000.

Designed to interface with the ST's high-speed DMA port and incorporating a standard laser engine, the Atari laser printer will produce rapid throughput at 300 dots per inch resolution, and it can handle multiple and standard page description languages.

Atari hardware engineering division head Shiraz Shivji said: "We have designed an admirable flexible system that includes all the advantages and few of the disadvantages of present laser printer architecture.

"The printer will be able to handle multiple fonts and standard page description languages at the discretion of the software. Moreover, adapting present software to take full advantage of the capabilities of the laser printer should be fairly simple providing it has been written in conformance with Gem standards".

ST SOFTWARE GALORE

A SURVEY has shown that more than 1,000 titles are now available for the ST range. This compares with some 300 recorded in September last year and 650 in November. Though these are global figures UK software houses have accounted for almost half of the packages.

The British will also figure prominently in the next wave, with more than 430 companies reported to be currently developing new products.

This demonstration of support for the ST has been warmly welcomed by Roland Whitehouse, Atari UK's new marketing support manager software.

"We believe there is no reason why the current total should not have doubled by the end of the year", he told *Atari User*.

However from now on Roland Whitehouse and his team will be placing the emphasis on quality rather than quantity. In the light of this, Atari has been particularly pleased by the number of major software houses who have thrown their weight behind the ST.

"When you get firms like Grafox with Logistics and MicroSoft with Write jumping on board then you know you are on target", said the new software boss. "We are also aware of many other firms of that status who are developing products for the ST. The big boys are on their way".

A breakdown of the 1,000 title bonanza for the

**Mike
Cowley
reporting**

ST SOFTWARE

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ST shows that entertainment software provides the largest category with 20 per cent. But this is followed close behind by word processing, utilities and languages – all with 10 per cent – then accounts, comms, music, education and graphics with around 5 per cent each.

At the bottom of the percentage league table come spreadsheets and CAD. But this situation is unlikely to remain this way for long, for the second generation of ST software is likely to find vertical applications figuring prominently.

"This year is going to be a very exciting time for the ST market here in the UK in particular", says Roland Whitehouse.

SOFTWARE SNAG SOLVED

SINCE the recent launch of the 520STFM, a number of cases have been reported of people returning the machines to dealers claiming they were faulty. Closer examination revealed that the problem lay not with the hardware but with some copy protected software, in particular with Arena, Cards, Deep Space, Q Ball and World Games.

An investigation by Atari experts revealed that copy protection schemes which involve the use of disc drive tracks outside the normal operating specification may not run on all ST disc drives.

Technical boss Les Player explained:

"This is due to the fact that disc drive manufacturers – of which there are several for the ST – guarantee the performance of their drives up to certain track limits. Access to tracks beyond this limit is not guaranteed.

"For example, the 520ST currently uses a Chinon 6ms drive which is guaranteed to access tracks between 1 and 81. Some software developers use track 82 – which can not normally be

written on – from which to read a protection code. This drive cannot access track 82 because it is beyond the specification of the hardware and therefore the software fails to load due to the protection code failing to load.

"Some software also uses protection based on timing techniques which may also cause load problems on certain manufacturers' disc drives".

Atari has now informed all the developers of these facts and problems should not occur in the future.

SHOT ACROSS PIRATES' BOWS

A LEADING duplicating house has come up with a revolutionary technique which it claims will put ST software pirates out of business.

Top Copy has spent the last year designing a black box which connects to a normal disc drive. The box destroys part of the magnetism on one of the tracks of the disc, making sectors on this track unstable. Every time a checksum is taken a different number is returned.

"To make the system secure the customer is asked to pick a number from one to 80 and the relevant track is then amended", said John Juleff, managing director of Top Copy.

Routines can be added to the original program to check the sector and verify that the disc is an original. The disc cannot then be copied by normal software means.

"There is no way to crack the system without the use of a black box and we're not selling these off because we want the duplicating business", said Juleff.

Prices for the service range from £1.50 a copy for a minimum of 100 discs to £1.15 a copy for a maximum of 100,000 discs.



MacEMULATOR ROMs ARRIVE

A SHIPMENT of roms needed to make the controversial "MacEmulator" work on the Atari ST has arrived in the UK.

It has been brought in by Eagle Computers of Cardiff who are now marketing them for £29.95 a pair.

This follows the importing of the boards from America by Middlesex-based distributor Robtek last month.

Now by combining the board – being sold for £169.95 – with two of the roms, it is claimed that an ST can be effectively turned into an Apple Macintosh. As well as providing access to an entire new range of top flight business software, the emulator also opens up the possibility of professional desktop publishing on the ST.

It was first shown in America early last year but was hurriedly withdrawn when Apple threatened legal action.

This was because the original design incorporated two Macintosh roms necessary for an effective interface between software and machine.

It was subsequently re-released without the roms, leaving purchasers to persuade Apple dealers to sell them roms.

Since then Apple has threatened to strike off

any dealers who supply them for this purpose. However Howard Kennedy, a director of Eagle Computers, told *Atari User* that he thought his company was on safe ground selling the roms in the UK.

"First of all, we are not an Apple dealer", he said, "and we are supplying them completely independently of Robtek. So we are very happy for people to know what we are doing".

Asked how successful he thought the emulator would be, Kennedy replied:

"All I know is I've sold an awful lot of these roms. On the basis of this alone, I believe they must have sold 1,000 boards already. But that's hardly surprising when you consider that for around £650 you can in effect have a Macintosh built around a 520STFM".

Asked about the source of his roms, he replied: "That's one thing I'm not going to tell you".

There has been little in the way of official comment from Atari itself about the emulator. However one informed source who had seen one says he believes that it has at least one major drawback: "You need a Macintosh alongside your ST with emulator in order to convert programs to ST format", he said.

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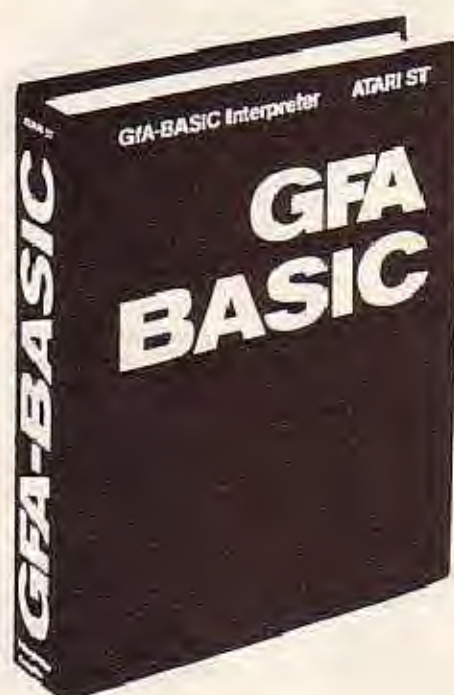
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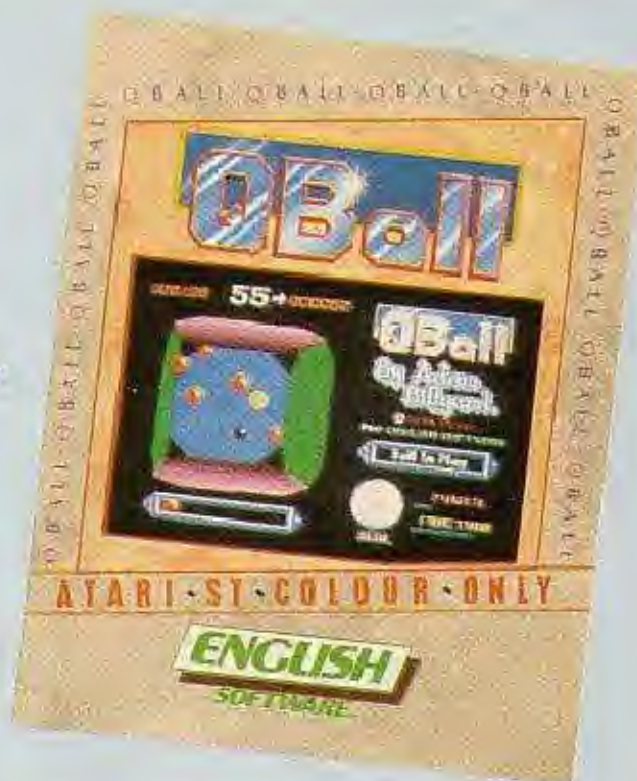
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Long on expertise, short on interest



Program: QBall
Price: £19.95
Supplier: English Software, 1 North Parade, Parsonage Gardens, Manchester M3 2NH.
Tel: 061-835 1358

TO put it simply, QBall is something of a combination of Newton's Cradle and three-dimensional billiards. The screen is divided vertically into two halves. To the left is a large, transparent cube containing several billiard balls. To the right is the game logo and input prompt.

The aim of the game is to pot the six red and one yellow balls into any of the eight corner pockets of the table by cannoning a black cue ball into them.

The table is really a large suspended cube with its front face open so that you can see what is going on inside. By using the appropriate cursor keys, the cube can be rotated horizontally and vertically.

When horizontally shifted, the cube rotates smoothly and swiftly before your eyes. When rotated vertically, the picture simply switches to show the new position.

The game is played using the ST's numeric keypad. The first step is to move the cue ball to any position you like within the cube. Next, a pulsating, black ball will appear - this represents the spot at which you are aiming and can similarly be moved around.

The amount of power, friction and spin are then optionally set. The more friction you use, the faster and longer the balls will career around the cube.

When all is ready, pressing the asterisk key fires your cue ball. If struck, the balls will start bouncing about the cube like demented bubbles, and with a bit of luck at least one may pop down a pocket. The yellow ball must be the last one potted, otherwise it just keeps reappearing.

A countdown timer keeps the pressure on you to set up your next play. When the timer reaches

zero the cue ball will automatically fire, ready or not.

And that's about it, really. You just keep potting away until all the balls are safely tucked up in bed. It may sound easy, but because of the 3D element, it's anything but.

As a programming feat, QBall is quite impressive. As a sort of executive toy, you could even say that it has a certain restful fascination about it. But as a game, I am afraid that QBall simply doesn't have enough going for it. Despite the undoubted challenge it provides, it lacks excitement and variety.

I may be wrong, but I would think that most games enthusiasts are unlikely to be kept interested beyond the first few plays. And £20 is a lot of money to spend on an executive toy.

Sound	4
Graphics	8
Playability	7
Value for money	6
Overall	6

**Reviewed
by Douglas
Wooller**





Program: *Mercenary*
Price: £24.95
Supplier: Novagen, 142 Alcester Road, Birmingham B13 8HS
Tel: 021-449 9516

HAVING seen just how impressive Paul Woakes' *Mercenary* was on the 8 bit Atari micros, I wondered if it could be bettered on the ST. It has – and how!

Apart from the much sharper graphics, the game seems at first sight to be almost identical to the original.

The neat opening sequence has you going out of control in outer space and crash landing on the planet Targ. Nearby is the conveniently abandoned alien space craft which will be your initial means of transport around the planet.

You step into the craft, start her up... and then you'll be struck dumb. Ever gone from 0 to 1,000 mph in a second? You will in *Mercenary*.

The game's speed is sensational, and incredibly smooth too. Switch to top speed and you can hurtle along the ground or through the air, screaming past, through, around, or over the many three-dimensional wire frame structures that adorn this strange land. It's totally exhilarating and all quite stunning.

And there's more good news – *Mercenary* has been packaged as a compendium. For your money you get two games – the original *Escape from Targ* and its sequel, *The Second City*, together with the Targ Survival Kit.

The latter is a sumptuous Help package, containing a comprehensive map of Targ, charts and a 27 page novella which itself provides an insight into the game's many secrets. The Kit comes in a sealed envelope bearing the legend "Only to be opened in an emergency"... but can you resist the temptation?

Mercenary is a superb blend of arcade action, adventure and flight simulation which uses astoundingly fast 3D vector graphics.

In *Escape From Targ* you play the part of an intergalactic soldier of fortune. You have crash-landed among an alien civilisation of two mutually hostile races, the Mechanoids and the Paly-

Mercenary gets into top gear



ars. Who will you choose to side with, bearing in mind that your ultimate objective is to escape?

The plot of *The Second City* is similar but the craft, landscape and locations have all changed. Conspiracy is rife and escape will be much more difficult – and you'll get no help from the Survival Kit, either!

Mercenary is the most exciting and intriguing game so far released for the ST. By itself, *Escape From Targ* would be worth every penny, but as a compendium, *Mercenary* cannot be topped for value. Three cheers for Paul Woakes and Novagen.

Sound	8
Graphics	10
Playability	10
Value for money	10
Overall	10

No trivial challenge

Program: *Trivia Challenge I*
Price: £19.95
Supplier: Microdeal, PO Box 68, St Austell, Cornwall PL25 4YB
Tel: 0726 68020

WHO haunts Hastings Castle? Where are the live frog-eating championships? Which member of the British Royal Family had 11 fingers? Why am I asking such oddball questions?

If you have the sort of rubbish tip mind that is stuffed with more redundant knowledge than a treatise on the digestive tract of the Outer Mongolian liverwort, let me tell you that your hour of glory has come.

Equally, if you happen to be the type of wealthy egghead who can't walk past one of those Trivia arcade machines so beloved of pubs and hambur-

ger joints without feeding umpteen 20 pence pieces into it, then you're also going to save yourself a heap of silver.

Trivia Challenge I is styled exactly like one of those aforesaid arcade machines. The idea is to gain as high a score as you can by correctly answering questions from any of five categories – general knowledge, pop music, art, sport and science. There are 4,000 teasers all told.

You begin with a balance of \$10. Each play will cost you either a \$1 or 25 cents (like the machines, you get better value for money with the larger sum). Depending on the coin deposited, you will be given a number of credits. Once they have been exhausted you must feed in more money.

You select your subject from a drop down menu. Click on the Play icon and a question on

Reviews
by Bob
Chappell

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Film Director is supplied complete with demo files and a comprehensive user manual.

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FLEET STREET

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Publisher

Desktop publishing really comes into its own on the Atari ST, and the Fleet Street series uses the machine to its fullest capabilities.

Giving the user total control over text, graphics, and the complete page, Fleet Street Editor enables novice and professional alike to produce finished pages that would have cost hundreds of pounds each using traditional methods.

Features include:

- * Direct text entry or import from other word processors
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- * Full text editing and text and graphics manipulation facilities in page make-up
- * Any page size from A5 to tabloid or user-definable, with any number of columns and variable margins and automatically computed gutters

Fleet Street Publisher runs under GEM and will output as standard to a dot matrix printer. Laser printer drivers will be available in the New Year, together with additional fonts and graphics libraries.

Fleet Street Publisher is supplied complete with comprehensive manual.

£115 inc VAT

More detailed brochures on each of these packages can be obtained from Mirrorsoft at the address at the foot of the page.

For complete hardware-and-software packages, contact:

Andromeda Software, 200 Brent Street,
London NW4. Tel: 01-203 6366

SDL, 1-4 The Mews, Hatherley Rd, Sidcup,
Kent DA14 4DX. Tel: 01-309 1111

Haba Systems Ltd, Lonbridge Delta, Pier Road,
North Feltham Trading Estate,
Middlesex TW14 0TT. Tel: 01-751 6451

PS Don't forget Mirrorsoft publish games for the Atari ST too!

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your chosen subject appears. After a pause long enough for you to read the question, three answers appear, only one of which is correct. A timer starts to count you down.

The faster you click on the correct answer, the more points you'll earn. Gain 1,000 points and you'll win \$1, 1500 points \$1.50, and so on. Slow but sure may be a better tactic, though – answer two questions incorrectly and that play is over.

The game also includes a simple facility for designing your own question sets and storing them on the master disc. Your sets can have any title but only one can be called up and stored in memory at any time (it always occupies the General Knowledge slot).

However you could probably get round this single slot limitation by giving your sets the same names as the original categories, regardless of the contents, for example you could have a set about gardening but entitled science.

You would need to save the original question sets to another disc before deleting them from the master disc. Files can be copied, written and deleted to the master disc as long as you don't reformat it.

The game only runs in medium resolution so you might have difficulty in reading the questions and answers unless you have a monitor or a good TV. Judging by the number in the title, sequels seem a distinct prospect.

The same questions can appear in a single



session but since by then you should know the correct answer, at least that gives you an easy chance to rack up your score. Sound is minimal (a few beeps) and the graphics are rudimentary – but does that matter in a game of this nature?

Trivia Challenge I is good, cheap, trivial fun. Buy it, play it then bore everyone to death with your new-found knowledge.

Sound	1
Graphics	4
Playability	8
Value for money	8
Overall	7

520 STM

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Storage solution for ST programs



THE first question this month comes from Alan Thompson who is writing a Computer Aided Design (CAD) modelling program for the ST. He is having trouble developing techniques for hidden line removal, a method whereby lines which appear behind 3D objects aren't drawn.

A visit to your local university book shop will provide you with some useful, if expensive, books. Probably the best of these is *Fundamentals Of Interactive Computer Graphics* by Foley and Van Dam from Addison Wesley, which costs around £25.

Mr M. Bann from Basildon asks why most ST programs insist on placing help files on disc rather than in memory. He argues that this means that you waste space on all your discs which could be used for data storage.

The main reason behind having help files on disc is that most software companies want to be able to sell their programs abroad. To translate a program into French or Spanish, they only have to rewrite the text files on disc, rather than having to rewrite and recompile the entire program.

One possible solution to your problem is to run your program from a double sided or hard disc drive. In this way, you will have more room for your data files.

Mr Bann also asks why some ST programs display a message when you run them, asking you to set the correct resolution, while others simply change the resolution themselves.

Although it is possible for a program to change from one resolution to another, you will find that programs that use Gem rarely do, because the Gem desktop cannot cope with having its resolution changed without rebooting.

If a Gem based program such as a word processor changed resolution from, say, low to medium and then returned to the desktop, the ST would almost certainly crash. Programs which do change resolution, such as *Starglider*, do not return the user to the desktop and therefore do not have to worry about Gem.

Gavin Johnson from Green Wotton wants to know if his copy of *Starglider* has a bug. In our review in the December issue of *Atari ST User*, I stated that it takes more than one missile to destroy *Starglider One*. Gavin complains that on his copy it only requires one missile.

On the lower levels, the game is much easier to play than when you have progressed. If you manage to reach the higher levels, you will find that it takes much more than one missile to destroy Hermann's flagship.

Mr D. Leigh wants to know more about the inter-

nal workings of his ST and wants to know which books are best. I recommend the First Publishing range of ST books. They cover Gem, TOS, assembly language and C in depth, but without leaving the beginner with a lost feeling.

Jeff Gardener from Hemel Hempstead writes to ask about blank 3.5in discs. We have all seen adverts from companies that sell discs at prices which seem almost free when compared to those of the high street stores and Jeff wants to know if discs without a big name label on them can safely be bought for the ST.

Like video tapes, blank discs of all sizes are made by a very small number of companies, most of which are based in the Far East. All the discs are tested for reliability. Those that fail the double sided test are sold as single sided and those that fail the single sided test are thrown away.

A percentage of the good discs are labelled with big names, while the remainder are left unlabelled. These latter are used by duplicating companies which produce discs for software companies, and by some of the smaller disc companies.

Therefore, if you own a brand name disc which cost £3.50 and an unlabelled disc which you bought for £1.50, there is a good chance that they both started life in the same factory.

HINTS AND TIPS

My thanks to Reg Williamson who has written to tell me how to stop Fast Basic from producing the same set of random numbers continuously. The solution is to place:

dummy%=RND(-TIME)

at the start of your programs. This will produce a new seed for the random number generator and thereby produce different random numbers.

Matthew Westby has supplied me with three hints for using Atari's Neochrome more easily:

- Double clicking on the eraser will delete the area of the drawing which is showing.
- When in Pencil mode, pressing the right mouse button will turn the pencil into an eraser.
- Pressing the right mouse button in Line Draw mode will draw a line made up of all of the colours in the current palette between the two markers.

Send your Atari ST queries to:
Atari ST User,
Europa House,
68 Chester Road,
Hazel Grove,
Stockport
SK7 5NY.



David Jones gets his ST to tell him the time

IF you've just bought a copy of Computer Concepts' Fast Basic cartridge for the ST, you'll probably have been playing with its fascinating built-in speech module. This Fast Basic program uses the module to turn your ST into a speaking clock – albeit a very expensive one.

Speaking clock works in any screen resolution. The current system time is displayed in the centre of the screen and every 10 seconds the program speaks the time adding "o'clock".

To use it, simply set the system clock with the control panel desk accessory and then run the program from Fast Basic. To stop the program press any key and the Fast Basic windows will be restored.

The program is split into several procedures. *Resolution* finds out which screen mode is being used and sets clock position and colour accordingly.

Initialisation sets up the array which holds the numbers in text form ready to be spoken and loads the speech module from the disc.

Time extracts the hour, minutes and seconds from the system clock and converts them into words ready to be spoken by the speech module.

Close clears the screen and restores the windows and mouse pointer.

Speaking Clock



```
*****
*   --- SPEAKING CLOCK ---   *
*                               *
* Program ID: SAYTIME.BSC    *
* Programmer: David Jones    *
* Date:      23rd Nov 86     *
*                               *
*****

PROCresolution
PROCinit
PROCtime
stored_sec%:=second%
REPEAT
  PROCtime
  PRINT TAB(x%,y%) times
  key%:=INKEY
  UNTIL second% MOD 10=0 OR key%<>=1
  IF second%>stored_sec% THEN
    stored_sec%:=second%
    !! continue%
  ENDIF
UNTIL key%<>=1
PROCclose
END

\
\ PROCEDURE DEFINITIONS
\ *****
\
DEF PROCresolution
  res%:=PEEK($44C)
  SWITCH res%
  CASE 0
    x%:=51;y%:=2:PAPER 12:INK 4
  CASE 1
    x%:=13;y%:=2:PAPER 3:INK 2
  CASE 2
    x%:=14;y%:=5
  END SWITCH
ENDPROC

DEF PROCinit
  HIDEHOUSE
  TEXTSIZE 26
  oh%:=OUTHANDLE
  GETWINDCOORDS oh%,xc%,yc%,wc%,hc%
  GETWINDFULL oh%,xf%,yf%,wf%,hf%
  SETWINDCOORDS oh%,xf%,yf%,wf%,hf%
  TEXTRECT xf%,yf%,wf%,hf%
  TOP=1
  CLS
  stored_sec%:=0
  DIM number$(23)
```

```
FOR ix=1 TO 23
  READ number$(ix)
NEXT ix
DATA "ONE","TWO","THREE","FOUR","FIVE","SIX","SEVEN","EIGHT","NINE"
DATA "TEN","ELEVEN","TWELVE","THIRTEEN","FOURTEEN","FIFTEEN"
DATA "SIXTEEN","SEVENTEEN","EIGHTEEN","NINETEEN"
DATA "TWENTY","THIRTY","FORTY","FIFTY"
LAUNCH "SPEAK.PRO","B",8,RZ
ENDPROC

\
\ DEF PROCtime
  times%:=TIME(2$(SYSTEMTIME))
  hour%:=LEFT$(times%,2):hour%:=VAL(hour%)
  minute%:=MID$(times%,4,2):minute%:=VAL(minute%)
  second%:=MID$(times%,7,2):second%:=VAL(second%)
  IF hour%=0 THEN
    conhour%:="ZERO"
  ELSE
    conhour%:=FNconvert(hour%)
  ENDIF
  conhour%:=conhour%+" "
  IF minute%=0 THEN
    conminute%:="O CLOCK"
  ELSE
    conminute%:=FNconvert(minute%)
    IF minute%<10 THEN conminute%:="0 "+conminute%
  ENDIF
  IF second%>0 THEN conminute%:=conminute%+" and "
  IF second%=0 THEN
    consecond%:=" EXACTLY"
  ELSE
    consecond%:=FNconvert(second%)+ " second"
  ENDIF
  IF second%>1 THEN consecond%:=consecond%+"s"
  times%:=conhour%+conminute%+consecond%
ENDPROC

\
\ DEF PROCclose
  SETWINDCOORDS oh%,xc%,yc%,wc%,hc%
  TEXTRECT xc%,yc%,wc%,hc%
  CLS
  TOP=2
  SHOWHOUSE
ENDPROC

\
\ FUNCTION DEFINITION
\ *****
\
DEF FNconvert(figure%)
  IF figure%<20 THEN
    figure%:=number$(figure%)
  ELSE
    figure%:=number$(118+figure%/10)+" "+number$(figure% MOD 10)
  ENDIF
  =figure%
```




If you've written any useful or interesting five line programs in either Atari Basic, Fast Basic or Logo, why not send them in to our five-liners section for ST owners?
We pay £25 for each one published.

Simply send a copy on disc along with a clear listing and good explanatory notes to:

*ST Five-liners, Atari User,
Europa House, 68 Chester Road,
Hazel Grove, Stockport SK7 5NY.*

MANDELBROT SET

from P.S. HAND

THIS program generates a fractal-like Mandelbrot set on the ST's low resolution screen.

The program takes over two hours to complete the image and then saves it to disc under the name "PIC.BAS".

If you don't fancy waiting for 2 hours, you can speed up the program by changing lines 2 and 5 to:

```
2 for p=0 to 300 step 8:for q=0 to 160
  step 9: ... (rest of line)
5 color i:gotoxy p/8,q/9:?"*";next p,q
... (rest of line)
```

These changes will make the program plot the same picture

using characters rather than individual points.

Line Breakdown

- 1 Clears the screen and sets the horizontal and vertical magnification constants.
- 2 Initialises the two loops and starts the calculation.
- 3 Completes the calculation and performs a check to see if an acceptable value has been reached.
- 4 Checks on the number of colours already used.
- 5 Sets the colour, plots the point and goes to the next screen position. Saves the picture to disc when finished.

```
1 defseg=8:idefdbl s:=sytab+20:fullw 2:clearw 2:sh=2.76214e-2:sv=0.302
2 for p=1to 303:for q=1to 150:sw=-2.25+int(p/2)*sh:sn=-1.4+int(q/2)*sv:ix=0:iy=0:si=0
3 r=x^2+y^2:t=x^2-y^2+ix*y=2*x*y+ix*t:ti=i+1:if r=100 then 5
4 if i=15 then 5 else if r<100 and i<15 then 3
5 color i,i:linef p,q,p,q:next p,q:reset:=peek(s):save"pic",d,32767
```

POLYS

from DR.S.CHERIAN

THE POLY primitive in ST Logo is fiddly and difficult to use. POLYS is an alternative which will draw a polygon (including triangles and squares) at any chosen locus on the graphics screen.

The inputs are: Length of side, number of sides, line colour and X and Y coordinates of start position.

Line Breakdown

- 1 Defines the routine POLYS and takes the inputs.

- 2 Places the pen at the start position and sets the colour.
- 3 Draws the sides of the polygon.
- 4 Moves the pen inside and fills the polygon.
- 5 Ends the routine.

```
TO POLYS :SIDE :NUM :COL :X :Y
PU SETX :X SETY :Y SETPC :COL PD
REPEAT :NUM [FD :SIDE RT 360 / :NUM]
PU RT 60 FD 10 PD FILL HT
END
```


FAST

FAST BASIC

Atari ST cartridge

A new and very fast BASIC interpreter ROM cartridge for the Atari ST computers. This 128K program has been written specifically for the Atari ST computers and so makes full use of (and gives the programmer full access to) all the special features of this machine.

Based around BBC BASIC, but considerably extended, FAST BASIC is a modern structured programming language. It is the ideal environment for those who want to experiment with the ST and to find out about GEM and 68000 assembly etc.

SPEED

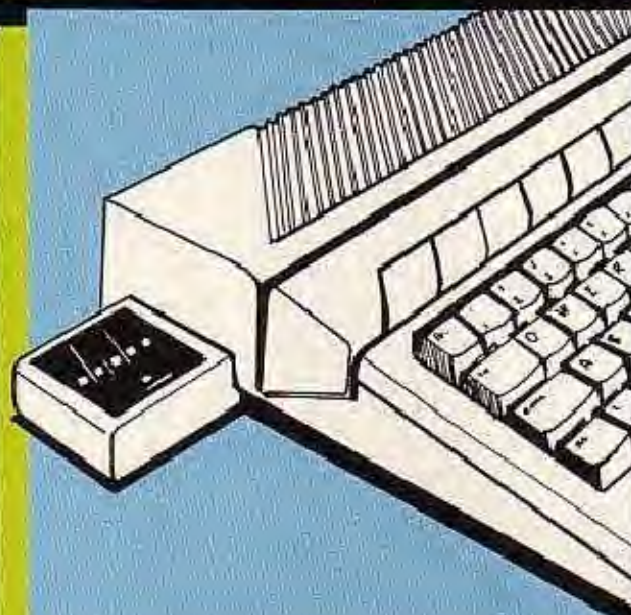
With an average PCW benchmark speed of 1.8 seconds, this is the fastest BASIC available (faster than any other PCW have tested) and is faster than BASIC running on the new Compaq 80386 super micro. See table for other comparisons.

EDITOR

A full GEM based scrolling editor is included. Supports search and replace, cut, copy, paste and very fast scrolling speeds. Multiple programs may be held in memory at once, and each program can have its own editing window and associated icon. A special immediate window allows commands to be used immediately without forming part of the BASIC program.

PROGRAM SIZE

There is no limit to program size, other than available memory, and there is no speed degradation for running large programs as there is on many other interpreters. Strings may be up to 64K long, arrays may be over 64K.



ASSEMBLER

Similar in concept to BBC BASIC, this allows mixing of assembly language and BASIC together. The assembler can assemble at over 50,000 lines per minute making it the fastest available. Macro and conditional assembly facilities combined with one of the best editors around makes this a superior alternative to many dedicated assemblers.

VARIABLES

FAST BASIC supports a full range of variables, 8, 16 and 32 bit integers for speed. Single and double precision floating point. Strings up to 64K and arrays of any size. The floating point maths routines are





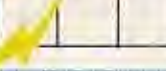
Price £89.90 inc. VAT and postage. Available from all good Atari dealers or directly from Computer Concepts.

FAST BASIC INCLUDES:

- ROM Cartridge - it uses no RAM, leaving the maximum available for BASIC programs. It does not have to be loaded from disc and so offers instant start-up and can be permanently available.
- Example disc containing a range of example programs from simple loops to complete GEM examples.
- Manual. Comprehensive 400 page spiral bound manual detailing all commands.
- Quick reference card



COMPARISONS

BASIC	PGW BENCHMARK	TIME
IBM PC		16.9
BBC B		14.6
MAC BASIC		7.1
ST BASIC		9.2
FAST BASIC		1.8 (Seconds)

BASIC

STRUCTURED

Programs are normally written without line numbers. This, in addition to named procedures and functions, ensures that FAST BASIC programs are easier to write and simpler to understand than any other programming language. It also supports REPEAT, UNTIL, WHILE, WEND and multi line IF, THEN, ELSE constructs, and in addition a powerful SWITCH, CASE, ENDSWITCH structure eliminates the use of multiple IF, THEN statements. FAST BASIC supports many of the best features of languages like PASCAL or C, but without the drawbacks.

Review

"...it positively flies."
"Students of structured programming will be well pleased."
"Perhaps the most staggering advantage of Fast BASIC over the official lingo concerns using the various facilities offered by GEM."
"...it's a vast improvement on Atari BASIC."

Popular Computing Weekly

Review

"The Fast BASIC package provides a complete system for the home programmer; the language is beautifully structured."
"The cartridge spans the gap between high level and low level programming languages and combines some excellent high level structures...It seems to have the advantages of languages like C and Pascal, without the restrictions."
"Bear in mind the fact that the cheapest assembler for the ST costs £39.95, this can only leave you to conclude that Fast BASIC really is phenomenal value for money."
"If you need a good programming language for home, business, or educational use, buy FAST BASIC. If you would like to program GEM applications but do not feel competent enough to tackle C, buy FAST BASIC. If you need a macro assembler with a good editor and environment, buy FAST BASIC."

ST User magazine - Oct 86

◊ Desk File Edit List Run Special

FRACTAL.BSC

```
REM Fractal graphics
REM from Scientific American.
REM Adapted by Phil Martin

REM Runs in any mode.

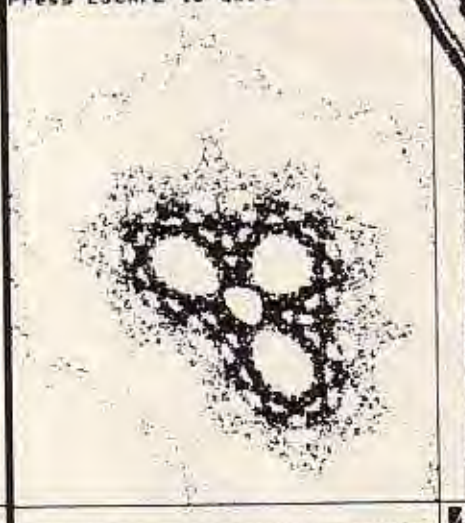
xo%=GRAFWIDTH/2:yo%=GRAFHEIGHT/
HIDEMOUSE
X=0
Y=0
REM (Try 3,2,1 for starters)
INPUT "Type in any three numbers"

REM Plot dots, try with other
MARKTYPE 1

HOME:CLG 0:PRINT "Press ESCAPE t
```

Output

Press ESCAPE to quit



ST
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EXAMPLE SCREEN

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COMPUTERS and science fiction have always had more than a little in common, and as often as not you'll find that an interest in one of them will quickly breed an interest in the other. For this reason, if for no other, Beyond Software is certain to have a winner with its first offering for the ST – a fantastic computer simulation (game is too tame a word) of the classic TV space opera *Star Trek*.

Late last year I was lucky enough to be beamed aboard the USS Enterprise in the form of a pre-release version of the game, or to give it its full title, *Star Trek: The Rebel Universe*.

The theme could have come straight from an episode of the series itself, and we find the Enterprise battling against a combined force of the Federation's worst enemies. The Klingons and the Romulans have teamed up with a number of rebel Star Fleet captains to create a force powerful enough to overthrow the forces of good.

Fortunately for the United Federation of Planets, someone has had the good sense – not to mention considerable technical skill – to surround the enemy portion of the galaxy with a force field known as the Klein Sphere. As the Enterprise was the only starship in the vicinity at the time, Captain Kirk and his crew have been ordered into the zone to attempt to quell the rebellion.

Against this background is played a game which falls part way between adventure and arcade in style, with digitised sound and some amazing graphics adding to the atmosphere.

The game play centres around a display of the bridge of the Enterprise, around which are panels for each of the main crew members. In order to call on one of them for help – or to issue a command – you click on the relevant character and their full display fills the main working area of the screen. A nice little touch is the way the mouse pointer is represented as a small Star Fleet insignia.

All the regular favourites are there, drawn to

Star just out of this world



perfection by artist Steve Cain. Each character has his or her own area of responsibility, often with more than one control panel at their disposal. Sulu is in charge of the ship's navigation, Chekov the weaponry systems, Mr Scott the state of the engines, and so on.

Mr Spock, Uhura and Dr McCoy are used mainly to provide information and assistance, and play a much lesser role than their TV counterparts. Captain Kirk, of course, oversees and coordinates the whole mission.

Each of the functions available to you have been modelled closely on the TV series, and the diehard fans will have little to complain about in terms of its faithfulness to the programme. The Enterprise has suddenly gained the power to speed off at warp 10 without blowing itself to pieces, and it seems to have grown a couple of extra phaser banks, but apart from these trivial points little would appear to have been altered.

You can navigate your way around the Klein-Sphere by using the ship's main Astrogator – an amazing 3D display unit allowing you to view the galaxy and plot a route through it.

You have a time limit to complete your mission, so speed is of the essence – but don't forget that charging around at warp factor 10 the whole time will drain your dilithium crystals in no time flat. There are hundreds of solar systems to explore, some of which may contain life-supporting planets, so plan your voyages carefully.

When you finally come across such a Class M planet you may use the transporter to beam down up to six of your crew, along with whatever equip-

Reviewed
by André
Willey





ment they currently have at their disposal. Once on the surface they will encounter a series of obstacles and problems, and there are also various items to collect, many of which will help you later in the mission.

No clues are given, but some intelligent guesses and good use of your crew's talents will go a long way to achieving your goal.

All of this would be tricky enough if it were not

for the fact that the Enterprise is under constant attack from enemy ships. You may fight back with your phasers and photon torpedos, aiming and firing via two 3D targeting and combat displays.

Digitised sound is used to excellent effect in this section of the game as you hear Chekov telling you that the phasers are locked on target, and as you hear the forward phaser banks blast their deadly beams out into space you will less frequently hear his exuberant cry "Got 'im!"

The final version of the game, which will be available shortly after you read this, will include a couple of extra finishing touches and must be a surefire candidate for game-of-the-year for 1987.

It is a classy mixture of the old faithful elements from the TV series and the latest advances in computer graphics and sound technology. One gets the feeling it's the sort of game you would find Captain Kirk playing with in a spare off duty moment. A must for all ST owners - I know that I'll certainly be spending a good deal of time with my ST as soon as the final copy comes through.

Graphics	10 +
Sound	9
Playability	9
Value for money	9
Overall	10

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ONE of the few problems with the ST which confronts every user is its inability to display all three resolutions on one monitor or TV. This means that you cannot show a picture designed on a high resolution monochrome monitor on a colour monitor in low or medium resolution and vice versa.

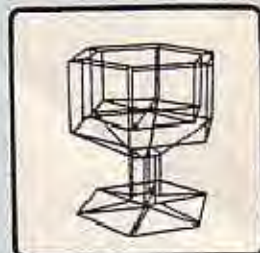
The problem stems from two areas. Firstly, Atari designed the ST's high resolution 80 column mode to use a very high quality monitor running at 70MHz. This frequency is unusually high and would almost certainly burn out a normal monitor, making it nearly impossible to use a display other than Atari's for high resolution work.

Secondly, although each of the three resolutions is stored in 32,000 bytes of memory, it is stored very differently from the other two. To understand this we must look at each resolution in turn. The most straightforward of the three is high resolution which is made up of 640 by 400 pixels. There are only two colours in high resolution - black and white. These make it ideal to have a bit representation of a point - one is black and zero is white. This means that a single horizontal row of 640 pixels is represented by 640 bits or 80 bytes. Multiply this by 400 rows and we get 32,000 bytes or nearly 32k of memory.

The colour resolutions are slightly more complicated than this. Medium resolution is made up of 640 by 200 pixels, each of which can be any of 4 colours from the ST's 512 colour range. These colours are determined by the current values of the ST's palette, which can be altered by using the control panel or from within a program. A colour of any pixel on the screen is therefore defined by two bits, which when taken together give the possible 4 colour choice, as shown in Table I.

Unfortunately the ST uses a system of interweaving which means that the two bits which represent a pixel are not stored next to each other in memory, but at the same position in

Resolving resolution problems



two adjoining words. Unlike the 8 bit Ataris, a word on the ST is made up of 16 bits - hence its name as a 16 bit computer.

To find the colour of the first pixel on the screen we must therefore take the value of the first bit in screen memory and pair it with the first bit of the next 16 bit word, which is 16 bits further on in memory. We then use Table I to find out which colour the pixel is being displayed in. For a further explanation, look at Figure I.

Horizontally, medium resolution is made up of 640 pixels, each of which requires 2 bits of storage. This makes a total of 1280 bits or 160 bytes of memory. Multiply this by 200 rows and we get 32,000 bytes.

The ST's low resolution is even more complicated, but crafted along the same lines as medium resolution. It is made up of 320 by 200 pixels, each of which can be any of 16 colours. Instead of 2 bits to represent a pixel, low resolution needs 4 bits, which taken together represent the possible range of 16 colours in a similar manner to Table I.

Four 16 bit words are taken together to represent each set of 16 pixels. Each digit of the binary number which represents the colour is taken from the next word along in the chain. Figure II explains this in more detail.

A low resolution pixel therefore takes 4 bits of screen memory and a complete horizontal row takes 1280 bits or 160 bytes which means that the complete screen of 200 rows once again takes 32,000 bytes of memory.

Since the colour of each of the pixels in low and medium modes is defined in terms of the value of

Colour	Bit Pattern
0	00
1	01
2	10
3	11

Table I

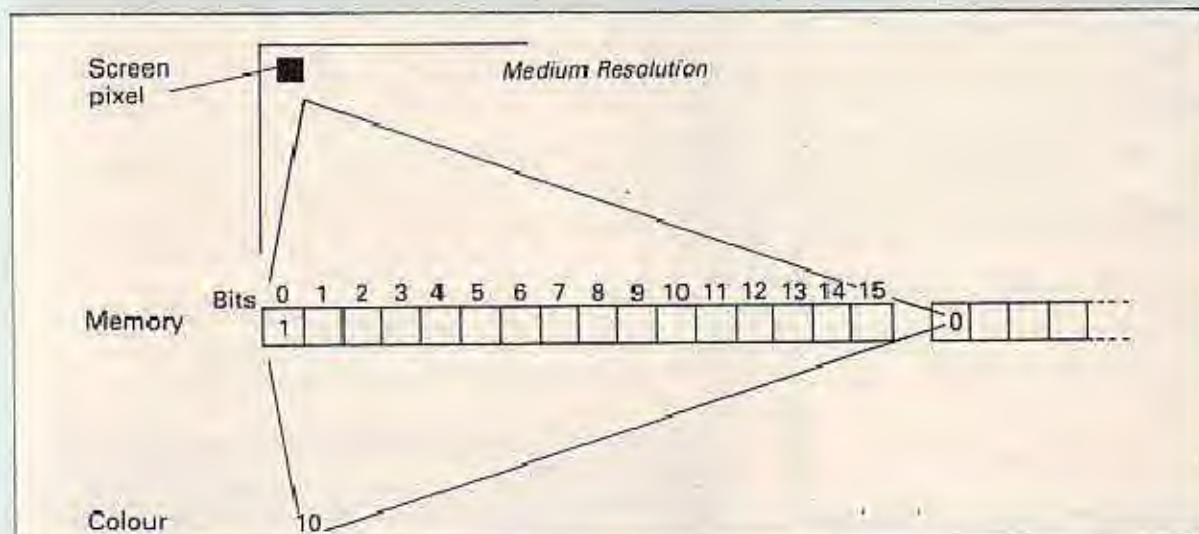


Figure I: Medium resolution

By
Andrew
Bennett

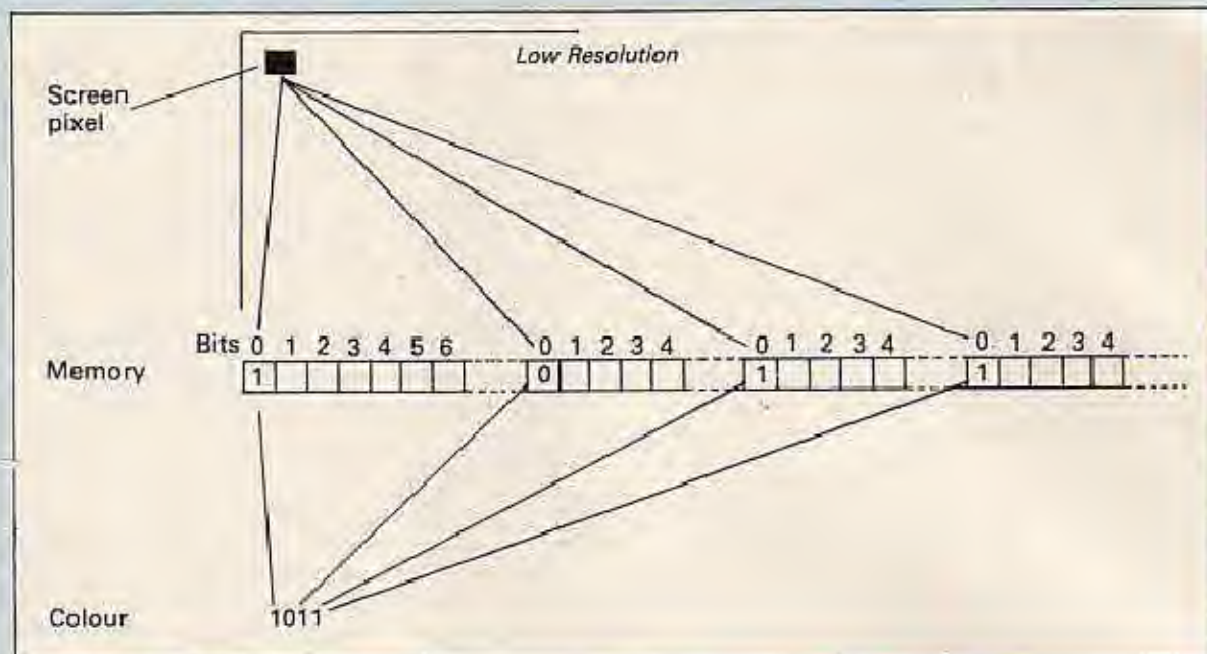


Figure 11: Low resolution

the ST's palette, it is possible simply to change the palette value – and all the corresponding pixels on the screen will also change automatically. This effect is called colour cycling and leads to such effects as the famous boink bouncing ball and the Neochrome waterfall demonstrations.

When the ST reserves memory for its screen, it

leaves aside 32k (32,768 bytes) of memory, but as we have seen a screen of any mode only requires 32,000 bytes. The extra 768 bytes of memory are normally wasted or can be used by the clever programmer for a small machine code routine, such as the screen dump program which we published in the November 1986 issue of *Atari ST User*.



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 - 320x200 low resolution - 16 colours
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520ST-M

The affordability of Atari computers is reflected in the price of the 520ST-M keyboard, which is a mere £259 (inc VAT). This version of the ST comes with 512K RAM, as well as a modulator and lead for direct connection to any domestic TV. The price does not include a mouse. In addition, when you buy your 520ST-M from Silica, you will also receive the FREE Silica ST Starter Kit. During 1987, many software houses will be producing games software on ROM cartridges, which will plug directly into the cartridge slot on the 520ST-M keyboard, giving instant loading without the expense of purchasing a disk drive. With the enormous power of the ST, you can expect some excellent titles to be produced, making this the ultimate games machine! If your requirement is for a terminal, then the 520ST-M can fulfill this role too. Leads are available to connect the ST to a variety of modems, and with the imminent introduction of terminal software on ROM cartridge, the ST provides a low price terminal for business use. If you wish to take advantage of the massive range of disk software available for the ST range, you will need to purchase a disk drive. Atari have two floppy disk drives available, a 5 1/4" model £149 and a 5 1/4" model £199. Full details of these drives, as well as the Atari 20MB hard disk are available on request. If required at a later date, the mouse may be purchased separately.

£259

520ST-FM

The 520ST-FM with 512K RAM and free mouse, represents a further breakthrough by Atari Corporation in the world of high power, low cost personal computing. This model is the latest addition to the ST family, and is not only powerful, but compact. It is priced at only £399 (inc VAT) a level which brings it within the reach of a whole new generation of computer enthusiasts. When purchased from us, it comes with the FREE Silica ST Starter Kit - see paragraph on the left. To make the 520ST-FM ready for use straight away, Atari have built into the keyboard a 1.1 megabyte disk drive for information storage and retrieval, allowing you easy access to the massive range of disk based software which is available for the ST. This new computer comes with all the correct cables and connections you will need to plug it straight into any standard domestic television set. You do not therefore have to purchase an Atari monitor. If you do require a monitor however, there are available with the 520ST in the following money saving packages.

- 520ST-FM Keyboard - Without Monitor - £399 (inc VAT)
- 520ST-FM Keyboard + High res mono monitor - £499 (inc VAT)
- 520ST-FM Keyboard + Low res colour monitor - £599 (inc VAT)
- 520ST-FM Keyboard + Med res colour monitor - £899 (inc VAT)

Because the 520ST-FM has its own power transformer built into the keyboard, there are no messy external adaptors to clutter up your desk space. You are left with only one main lead, serving both the disk drive and the computer. You couldn't ask for a more stylish and compact unit.

£399

1040ST-F

For the businessman and the more serious home user, Atari have their most powerful model, the 1040ST-F with 1024K RAM. This low cost powerhouse can be introduced into a business environment as a stand-alone system, or can support a mainframe computer as a terminal. The 1040ST-F not only features twice as much memory as the 520ST-FM, but also includes a more powerful built-in disk drive. The drive featured on the 1040ST-F is a one megabyte double sided model. The extra memory facility of the 1040ST-F makes it ideal for applications such as large databases or spreadsheets. Like the 520ST-FM, the 1040ST-F has a main transformer built into the console to give a compact and stylish unit with only one main lead. The 1040ST-F is also supplied from Silica Shop with a free software package and ST STARTER KIT. In the USA, the 1040ST-F has been sold with a TV modulator like the 520ST-FM. However, for the UK market, Atari are manufacturing the 1040ST-F solely with business use in mind and it does not currently include an RF modulator. This means that you cannot use it with a domestic TV (Silica Shop do offer a modulator upgrade for only £49). The 1040ST-F keyboard costs only £599 (inc VAT) and, unless a modulator upgrade is fitted, will require an Atari or third party monitor. There are three Atari monitors available and the prices for the 1040 with these monitors are as follows:

- 1040ST-F Keyboard - Without Monitor - £599 (inc VAT)
- 1040ST-F Keyboard + High res mono monitor - £699 (inc VAT)
- 1040ST-F Keyboard + Low res col monitor - £799 (inc VAT)
- 1040ST-F Keyboard + Med res col monitor - £899 (inc VAT)

The 1040ST-F comes with a mouse controller and includes 1Mbytes of RAM. It has a 1Mbyte double sided disk drive and a main transformer, both built into the keyboard to give a compact and stylish unit, with only one main lead.

£599



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ON my trips down the phone lines to the various bulletin boards on this side of the Atlantic this month I have noticed a growing awareness of the problems of downloading ST programs.

With connection charges ranging from a couple of dollars to more than \$20 an hour it is annoying to find that the program that looked most interesting when it was described takes over 20 minutes to download via the modem to your ST.

This problem doesn't affect 8 bit owners, because programs for their computers tend to be smaller than 40k of Basic or machine code, but programs for the ST have been known to be as long as 200k.

Even at 1200 baud this represents a large cost in connection time while the program is downloading and you don't even know whether the program will be as good as it sounds until you go off line and run it.

Another difficulty that ST owners face is that their programs are often made up of several files, including the



program's data and resource file. This makes downloading difficult and it can be very annoying to go off line only to find that you haven't downloaded a crucial data file.

There have been a number of attempts to overcome these difficulties and the most successful so far appears to be a program called ST-Arc, a direct descendant of an IBM archiver program rewritten to use Gem. It not only compresses programs and their data, but also joins them together into one file.

If you like the look of a particular program you simply download the singular file associated with it and then separate and decompress it using your copy of ST-Arc.

Cutting cost of downloading ST programs

ST-Arc is available for downloading on most of the bulletin boards in the States and is a must if you intend to download ST software.

There has been a definite shortage of good word processors for the ST so far, which has allowed the public domain program STWriter to become popular. It doesn't use the mouse or windows, but it is very fast and it supports dozens of printers.

Version 1.70 of STWriter has recently been rumoured and I'll be telling you about its features in a future *Atari User*.

A new extension to Gem has been released by Atari. Available only to software houses for insertion into their programs, Gdos allows programs to use many different fonts of the kind usually associated with Apple's Macintosh.

Gdos was originally omitted from the ST version of Gem because the programmers at Atari and Digital Research were having trouble squeezing it into the ST's 192k of rom memory.

Atari charges a royalty to the company on each product using Gdos, which means that you should only expect to see it used in programs from the larger software houses.

ST Flight Simulator II from Sublogic is similar in operation to the older ver-

sions to be found on the Commodore 64, Apple II and Atari 8 bits, except for the ST's higher resolution display.

The option that sets it far apart from its younger cousins is the ability to play a two player game. This isn't achieved by using different parts of the keyboard so that each player can control his plane, but by attaching two STs either by normal cable or via the phone lines using modems.

Each player flies the plane of his choice and as well as the usual buildings, mountains and other scenery he can see the other player's craft in 3D as it flies over the same terrain.

However the American ST game playing community has been slightly disappointed because it isn't possible to collide with or shoot at the other



player's plane. Sublogic is working feverishly to include these capabilities and hopes to have another version out soon. A leisurely flight over New York will never be the same again!

If you're interested in 3D graphics and how you can include them in your programs, look no further than a new book from Abacus. It teaches 3D computer aided design in C and discusses techniques such as rotation, shading and hidden line elimination.

The truth about TELEX

How much does it cost to go on Telex?

You could go the conventional way and buy a dedicated Telex machine. The cheapest will cost you £1,604 (the Whisper), the dearest £2,892 (the Cheetah). You will also need a separate telephone line, costing £101 to install, plus £404 a year rental. That's a total outlay over the first year of a minimum of £2,109. (All prices include VAT.)

Or you could do what more and more micro users are doing - use your Atari to double as a Telex machine. And just use your ordinary telephone!

How do I turn my Atari into a Telex machine?

All you need is a modem and appropriate communications software (see the advertisements in this issue), a telephone, and a subscription to *MicroLink*.

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Degas takes big stride forward



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IF you are interested in art and graphics on your ST the chances are that you will already have a copy of Tom Hudson's Degas graphic drawing package. This followed on from Atari's freebie NeoChrome and quickly established itself to such an extent that many other commercial packages offer the facility to load and save Degas picture files.

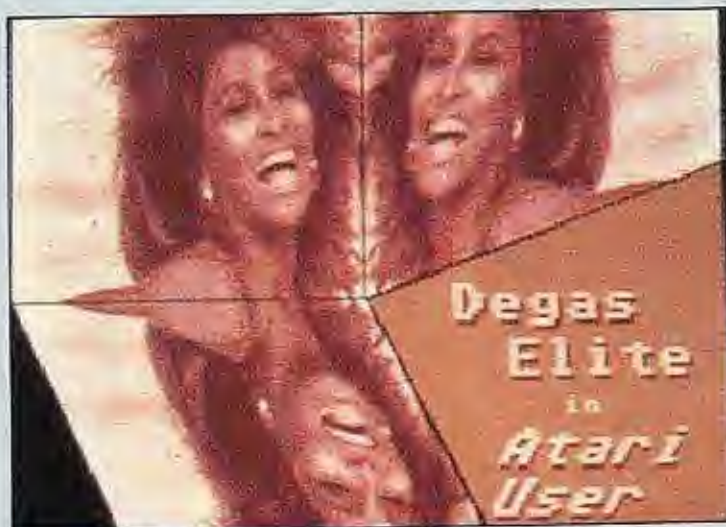
In the meantime Tom has not been sitting on his laurels. Since completing his excellent CAD 3D program he has been working on the long awaited update to Degas.

Anyone familiar with Degas will immediately feel at home with the controls of Degas Elite. There are still the two main screens – the work screen and the menu – selected between by using the right mouse button. The left button selects menu items and is also used to draw with.

The main menu is still in the same format as the original version, but a whole host of additions have been made. Many of the awkward selections of such things as palette, fill pattern, line pattern and so on have been made much simpler.

You may now click through the choices or double click to open up a full selection menu box. You may double click on many other function buttons to open control windows, making usage of some of the more complex functions a very straightforward matter.

All of these options are also available from a set of comprehensive pull-down menus, and many



Degas Elite's block manipulation facilities can be used to create some amazing effects

may also be selected by using the keyboard while on the drawing screen – a great advantage over many of its competitors.

All the normal drawing commands are here – point, line, k-line, polygon, circle, box, fill and so on. New features include stipple and outline. Outline is a very useful tool which will create a single pixel wide border around any object in any colour. Fill has now been expanded to allow the use of some rather spectacular multi-coloured fill patterns.

Additionally, many functions may now be "smeared", which is a very easy way to blend two colours together. You simply select the smear option and then draw in the normal manner. Instead of a solid line, any colours under the brush will be mixed up and blended.

A new feature for Degas is the animation section, which features four separate animation controls which will cycle through the colour values in various given registers. This is an enhancement of the Neo animate feature and can be very powerful indeed, especially when used with cycle-drawing which will allow you to draw lines and patterns in the various colour cycle registers. This makes creating such pictures as the now famous waterfall a doddle.

The zoom facility of Degas has been expanded and you may now use any of the 10 function keys to give a magnification of between three and 12 times. This magnified view may be scrolled over the whole picture, modified and zoomed in and out at will.



The main menu of Degas Elite

**Reviewed
by André
Willey**



A complete new section of extremely powerful functions has been included which allows you to select a block of any size from your picture and store it in the block buffer. You may then paste it into another picture or use it as a brush and paint it back in again somewhere else on the same picture.

One of the most amazing things you can do with the block is to scale it up or down to any size, bend it, distort it, rotate it and generally do anything else you can think of to it. These options have to be seen to be believed, and I spent hours finding out what each one was capable of.

Loading and saving are now so versatile that you should never need to use another program again. You can load or save files from Neo, Degas, Amiga or 8 bit Atari Touch Tablet – in whatever resolution they happen to be – and Degas Elite will do its best to convert them into a suitable picture for the resolution you are currently working with.

It will even try to match up your palette values with the ones in the original file. This seems to work very well indeed, and I have converted a number of medium and high resolution pictures into low resolution with fantastic results.

The new load and save routines also allow you

to work with saved blocks, brushes, lines, fill patterns, full Gem fonts and even load in new palettes without losing the current picture and vice-versa.

If you are using a one megabyte machine you may have up to eight pictures in memory at once, and flip between them with a click of the mouse button. Even the humble 520 will allow you to work with two pictures at once, which itself is an improvement over the old Degas.

Overall then, Degas Elite improves in almost every area on the original. Everything has been made easier to use, and hundreds of new facilities have been added. The package is now probably the most sophisticated of the drawing/art programs available today – but who knows what tomorrow will bring?

Its only serious drawback is its price. At £69.95 it is perhaps a touch more expensive than many people would like, but you certainly will get your money's worth.

Features	10
Ease of use	9
Manual	8
Value for money	9
Overall	10

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